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DEPARTMENT

OF

Colonization, Mines and Fisheries

MINING OPERATIONS

IN THE

PROVINCE OF QUEBEC

FOR THE YEAR

1905

BY

J. OBALSKI,

MINING ENGINEER AND INSPECTOR OF MINES

QUEBEC
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Quebec, April, 1906.

HONORABLE JEAN PREVOST,

Minister of Colonization, Mines and Fisheries,
Quebec.

Sir,

I have the honor to submit my annual report on the Mines of the Province. The production has exceeded that of last year by about one million dollars. The discoveries at Chibogomo and Cobalt have encouraged prospectors and numerous applications for prospecting licenses in the northern districts of the Province between Lake Temiscamingue and Lake Mistassini, are coming in daily to the Bureau of Mines. I spent the last season at the Liege Exhibition as Commissioner for the Federal Government and I endeavored, to the best of my ability, to make our mineral wealth known in Europe. In this report you will find a special work by Mr. H. Nagant on rare earths in Quebec and an extract from a very important report by Mr. A. P. Low, Director of the Geological Survey, on the Chibogomo district.

I have the honor to be,

Sir,

Your obedient servant,

J. OBALSKI,
Superintendent of Mines.

MINING OPERATIONS

IRON

There has been no development in our iron mines with the exception of prospects and experiments in connection with the magnetic sands of the north shore of the St. Lawrence. It may, however, be stated that, according to borings beneath low-tide level, those sand deposits extend in certain cases to some distance out and could be dredged where the water is shallow.

Experiments in the treatment of iron ores in electric furnaces are being continued at Sault Ste. Marie under the patronage of the Federal Government but we must await a final report to know whether that process has really any commercial value.

The Radnor and Drummondville blast furnaces worked respectively by the Canada Iron Furnace Company and John McDougall & Co., were in operation for a portion of the year with the following results in tons of 2000 lbs.

Ore charged.......	17,513 $\frac{1605}{2000}$ tons	worth	$ 54,772
Limestone charged.	2,086 $\frac{1250}{2000}$ tons	do	1,388
Charcoal charged..	1,165,659 bushels	do	86,640

(The weight of the bushel being put at 20 lbs.)

Which produced 6,774 $\frac{913}{2000}$ tons of pig-iron worth $166,267

The ore used consists of bog ore from the counties of Champlain, St. Maurice, Joliette, Nicolet, Drummond and Vaudreuil. Nevertheless, 5,140 tons of ore, part of which came from Ontario, were used so that 12,373 tons of ore of the Province of Quebec worth $35,268 were used.

OCHRE.

The Canada Paint Company and the Champlain Oxyde Company worked during the open season at St. Malo, near Three Rivers, in extracting and calcining the natural ochre on the spot. That ochre was shipped to various parts of Canada and of the United States. The Canada Paint Company has works at Montreal, where the product is crushed and prepared for the market. About sixty workmen are employed for about six months and the production was 1,905 tons of 2,000 lbs. worth $22,675.

CHROMIC IRON.

The progress pointed out last year in this industry has continued and this year the production has greatly increased, while all the methods for mining and concentrating the ore have been improved. The use of electric power by the two leading companies is also an important point to be noted. An attempt has been made to introduce our ores on the European market, where they find dangerous competitors in the ores of Turkey and New Caledonia. Some shipments have, however, been made to England and to Germany.

The concentration of low grade ores and debris is now very effectively done and the companies regularly supply concentrates varying between 50 and 52 %, the Wilfley tables being used with success. During the year, the Black Lake Chrome and Asbestos Company was the chief producer, while the American Chrome Company did a little concentration and the Canadian Chrome Company set up concentration plant and works. The other companies did no work and produced nothing.

The Black Lake Company worked throughout the year and transformed its plant; the old mill near the lake was transported near the railway line and is connected with the mine by a tramway. It is now provided with 30 stamps and 7 Wilfley tables and the motive power used is electricity.

The old shaft No 1 was sunk still lower and has now reached a depth of over 300 feet with good indications of ore; compressed air machinery has been installed. Prospects are also being made on the property and old works have been taken up again.

The *Canadian Chrome Company* works the S. W. part of lot 16 of range A of Colraine. That company, formerly known as Nadeau & Co and afterwards as the Thetford Chrome Company, has its head office at St-Hyacinthe and proposes to develop that property on a large scale. During the summer concentration works were erected consisting of 10 stamps and 3 Wilfley tables and electric power is used which is supplied by the St-Francis Water Power Company. A considerable production by this company may therefore be expected for 1906.

The American Company produced little, but that company, which manufactures chrome products in Boston, bought a large quantity of ore from the other companies.

This industry gave employment to 125 men during the greater portion of the year and the production was as follows :

1st class, in rock.....	837	tons of 2000 lbs worth..	$ 10,450
2nd " "	3,406	" " " ..	30,654
Concentrate...........	4,285	" " " ..	63,461
Totals........	8,528		$104,565

COPPER

The Nichols and Eustis Companies continued to work regularly. The latter put up concentration works to utilize the large quantity of debris that had accumulated for some years.

The Ascot Mine was slightly worked with a few men, producing a small quantity of good grade ore which was treated at Capelton. The King Mine on lot 4, II Ascot, was sunk deeper, a few men being employed throughout the year, but no ore was shipped.

This year's yield for the whole region was 25,575 long tons of the value of $128,850, 14,172 tons of which were shipped to the United States and the remainder treated for sulphur and copper by the Nichols Chemical Company at Capelton ; 245 men were employed during the greater portion of the year.

ASBESTOS

The asbestos industry has continued to develop with the greatest success and this year the production was 25 per cent greater than last year while the prices have kept high. The new uses made of asbestos pulp are very encouraging and most remarkable imitations of wood are now seen which seem likely to have a good future. The result of the progress has been the opening of new mines which, until the present, had been considered as under less favorable conditions than the mines formerly worked. At Thetford, the Bell and King companies (the latter now being the American Asbestos Company), and the Johnston Company worked both mines and mills throughout the year with the greatest activity and the maximum of production.

It is proposed to introduce electricity as motive power in the mines and mills, the St. Francis Water-Power Company being prepared to supply it.

The Beaver Asbestos Company pratically did no work this year.

At Black Lake, the American, Johnston and Standard companies worked regularly and the yield was good.

The American Company, whose plant was described last year obtained good results this year and continued to adapt its plant to the conditions of the mine in which, as well as in the mill, the motive power is to be electricity.

The Glasgow and Montreal Company did a little work by contract, but the other mines, the Union, Manhattan and Reed, remained inactive.

At Broughton, the Broughton Asbestos Company Ltd. and the Quebec Asbestos Company Ltd. worked a portion of the year with a good production of fibre.

A new company, *The Asbestos Mining and Manufacturing Company*, of Providence, R. I, was organized to work a mine on the east half of lot 25, range IV of Wolfestown, formerly opened by Mr. S. Pete., of Quebec. With some forty men the mine has been put in good order and a defiberizing mill is being erected capable of crushing 350 tons of rock a day and provided with the usual machinery : breakers, dryers, separating tables and two cyclones. The mine will be provided with cable-derricks, steam-drills, etc. The total power employed will be represented by steam-boilers with a capacity of 350 horse-power.

At Danville, work has been continued with great activity with a production greater than in previous years. The company has put up two new cable-derricks.

In the same region, a new mine has been opened by Mr. R. H. Martin, of New York, on lots 19 and 20 of range XI of Tingwick. This property has long been known as showing good indications of asbestos, but it has hardly been prospected until now. The new owner, who is well known in the asbestos industry, had fifteen men at work there last season to ascertain the value of the lot and suitable plant will be put up if deemed advisable.

No work was done in connection with asbestos in the Ottawa region.

The discoveries made last year at Chibogomo have been confirmed, but that region cannot put its products on the market until a railway is built.

Activity in the asbestos industry has also called attention to indications found in Gaspesia and in the Témiscamingue region, but nothing has yet been done there.

The production of asbestos during the year 1905, in tons of 2000 lbs, was :

1st class, crude....	1,340	tons,	worth....	$ 221,325
2nd " "	2,258	"	"	243,785
Fibre................	10,707	"	"	386,440
Paper stock.........	34,655	"	"	624,900
Total..........	48,960	"	"	$1,476,450
Asbestic............	19,220	"	"	31,100

1650 workmen receiving $580,000 in wages were employed during periods of from 7 to 12 months. Seven companies produced regularly and actively, two of them working mines and mills at Thetford and Black Lake at the same time.

The production for last year (1904), not including asbectic, wa 35,479 tons worth $1,186,795, thus making an increase of 25 per cen for this year as already stated.

MICA

Mining for amber mica was continued this year in the county o Ottawa by some companies only, as was done last year.

Blackburn Bros, who are the most important producers of the region and who work the same mine in Templeton where steam and compressed air are used, also got out some hundreds of tons of phosphate. The mica, after a first sorting, is shipped to Ottawa and Hull, where the company has works, to be thumb-trimmed and split as required for the market.

The Wallingford Mica Manufacturing Company also mines in Templeton and prepares the mica at Ottawa.

Messrs Kent Bros., of Kingston, worked for the greater part of the year at the Morris mine on lot 14, VI of Hull, whence the mica is shipped in the crude state to Kingston where it is prepared. That company has put up steam machinery and its production this year has been considerable.

Messrs Fortin & Gravelle worked the whole year at their mine in Hull with a few men, the mica being prepared at Hull whence a good quantity was shipped.

Messrs Wallingford Bros have organized themselves into a company under the name of *Wallingford Bros, Ltd.* and work the following mines : the Rainville mine, Templeton VIII½ E. 16 ; Lake Rhéaume mine, Templeton Gore 8 ; Poupore mine, Portland East I, Ia. The company also owns several other lots in Templeton, not worked. This year it got out and shipped a certain quantity of mica.

The market for amber mica is fairly good, especially for small dimensions, and Ottawa continues to be the centre of preparation for mica from the Ontario and Quebec mines. The mining companies themselves prepare the mica from their mines at Ottawa and Hull, but the following companies must also be mentioned : The General Electric Company, the Laurentides Mica Company, E. Munsell and others of less importance, which have thoroughly fitted up works where the mica is trimmed and split or even cut in special shapes for shipment to the United States where it is transformed into micanite or other commercial products. The works are provided with knives and small tool-machines driven by steam or electricity and women are employed, as their labor is more suitable for such delicate work. This industry gives employment to not less than 600 women and girls at Hull and at Ottawa ; they are under the supervision of forewomen and work by piece-work, earning very reasonable wages.

A noteworthy fact is that mica is beginning to be shipped regularly to Europe and our amber mica is highly appreciated owing to its flexibility and its being easy to split.

While I was at the Liège Exhibition, we received many applications which were referred to the Canadian producers and I think that, when an understanding shall have been come to with reference to the merchantable form of that mica, a good market will be found for it in Europe. It is true, on the other hand, that we have to compete with the Indian mica which can be delivered at a very low price owing to the cheapness of labor in that country and it is a noteworthy fact that the companies mentioned above, which prepare mica at Ottawa, receive large quantities of Indian mica of small dimensions, very well prepared, which is split and mixed with Canadian mica for the manufacture of micanite. Those companies assert that it does not cost them more, delivered in Ottawa, than the mica of our own country.

The production in 1905, representing the quantities shipped, is as follows :

1/2	65666	lbs.	worth	$ 3852
1/3	159562	"	"	22316
2/3	63206	"	"	23165
2/4	45170	"	"	21739
3/5	16332	"	"	11012
4/6	6368	"	"	6190
5/8	857	"	"	786
Total thumb-trimmed	357160	"	"	$89060
Split	21400	"	"	6400
Total	378560	"	"	$95460

WHITE MICA AND RARE EARTHS.

There are several mines of white mica (muscovite) which hav not been worked of late years. Attention has, however, been calle to those mines in consequence of its having been found that the contained rare earths such as Uranium, Thorium, Yttrium, Cerium etc., and also of *Radium* having been found in them. Last summer a company whose head-office is in Paris, *The Canadian General Mining Company, Ltd*, bought the Maisonneuve mine in the county of Ber thier in which Samarskite was found and that of Pieds des Monts county of Charlevoix, containing Cleveite and *Radium*. It proposes to develop those mines and utilize those rare minerals which have hitherto been looked upon merely as mineralogical curiosities, but which in some parts of the veins seem more abundant than was supposed.

Last season, the Maisonneuve mine was worked with a dozen men and several tons were sent to Paris to be assayed. The company proposes to carry on operations on a large scale if the results are satisfactory.

In the environs of Lake St. John also, a mine of white mica has been opened in which are ores of Cerium.

In this report a special work on rare earths will be found and prospectors cannot be too strongly recommended to careful examine all unknown minerals they may meet in veins of pegmatite.

PHOSPHATE.

According to Mr. J. F. Higginson of Buckingham, the quantity of phosphate used in 1905 was as follows :

1rst class	950	tons with	$7,125
2nd do	200	do "	1,100
3rd do	325	do "	650
Total	1,475		$8,875

This phosphate came from Ottawa and partly from the mica mines, although a little was got from old phosphate mines. The better qualities were used in the Province in the manufacture of phosphorus and chemical phosphates, while the inferior qualities were used in making chemical fertilizers.

COMBUSTIBLE NATURAL GAS.

The Canadian Gas and Oil Company Ltd. continued boring the wells mentioned last year in the Beauséjour range near St. Grégoire, but without success. One of the two wells in that range has been bored to a depth of 1200 feet. Another was bored in the Grand Range to a depth of 500 feet but, without striking gas. The company then bored about fifteen wells at Yamachiche to a depth of 300 feet and found gas in some which is used for supplying residents of the place with light and fuel. Large quantities of salt water were also found which drowned the wells in some cases.

MISCELLANEOUS.

No work of any importance was done at Buckingham or at Calumet by the graphite companies.

Preparations are being made for developing mining for molybdenite in Egan township and for prospecting other districts where it has been recognized.

No work in connection with gold mining was done in Beauce or in Dudswell outside of the usual prospecting on a small scale.

No work in connection with petroleum was done in Gaspesia.

No work was done in connection with sulphate of baryta or with feldspar in the county of Ottawa.

At Farnham the putting up of plant for compressing peat has been continued and the company hopes to turn out products in the spring.

BUILDING MATERIALS.

The Portland cement industry has assumed great importance in consequence of the starting of the factory of the International Portland Cement Company Ltd., of Hull, which began making cement in 1905. Mr. Th. M. Morgan, of Longue Pointe, Montreal, also produced a good quantity of cement.

The total production for the two companies was 254,833 barrels worth $408,000, and it will be greatly increased in the future.

Slate was got out regularly at New Rockland and flag stones at Dudswell.

There is nothing special to note in connection with the quarrying of granite, building stone, etc., nor with the making of lime and bricks, which continue to be an important industry growing in proportion to the development of the country. As it is very difficult to get accurate figures regarding production, we will for the present give those of previous years.

SUMMARY STATEMENT OF THE YIELD OF THE MINES IN THE PROVINCE OF QUEBEC FOR THE YEAR 1905.

KIND OF MINERALS (Tons of 2,000 lbs.)	Wages paid.	Number of workmen.	Quantities shipped or used.	Gross value.
Bog iron ore	$ 22,000	120	12,373	$ 35,268
Chromic iron	52,000	125	8,528	104,565
Copper ore	90,928	245	28,644	128,850
Asbestos	576,700	1,650	48,960	1,476,450
Asbestic	....	....	19,220	31.100
Mica (pounds)	45,000	180	378,560	95,460
Calcined ochre	11,035	56	1,905	22,675
Phosphate	....	....	1,475	8,875
Slates (squares)	15,000	45	4,900	21,568
Flag-stones (square yds)	1,700	6	2,930	2.490
Cement (barrels)	150,000	160	254,833	408,000
Granite	70,000	180	....	120,000
Lime (bushels)	....	350	1 million	140,000
Bricks	600,000	1,200	120 "	625,000
Stone	....	700	....	530,000
Totals	$1,634,368	5,017	....	$3,750,300

In 1905, the value of the products of the mines was therefore $3,750,300.00 of mineral substances shipped or used, the value being taken at the mines in the raw state or after having undergone a first preparation to make the product merchantable.

5000 workmen were employed for periods varying between 5 and 12 months and their wages amounted to $1,634,000.00.

According to the reports received, 2 men were killed and 2 seriously injured in mining accidents.

6,774 tons of 2000 lbs of charcoal pig-iron, worth $166,267, were manufactured.

LIST OF MINING COMPANIES IN THE PROVINCE OF QUEBEC, IN OPERATION, OR IN A POSITION TO WORK, WITH THEIR ADDRESSES

MAGNETIC SAND

The Quebec Iron Ore Co., 75, St. Peter Street, Quebec.
H. C. Bossé, 112, St. Peter Street, Quebec.
W. Robertson, 233, St. James Street, Montreal.

CHARCOAL PIG-IRON

The Canada Iron Furnace Co., Canada Life Building, Montreal.
John McDougall & Co., 597, William street, Montreal.

TITANIC IRON

G. Gagnon, 87, Artillery Street, Quebec.

OCHRE

The Canada Paint Co., Ltd., 572, William street, Montreal.
The Champlain Oxyde Co. (Lucien Carignan), Three Rivers.

CHROMIC IRON

Black Lake Chrome & Asbestos Co., Black Lake, Co Megantic.
American Chrome Co., Black Lake.
Montreal Chrome Iron Co., Ltd., Colraine, Co. Megantic.
Star Chrome Co., Colraine.
Canadian Chrome Co., St-Hyacinthe.
King Bros Co, Thetford Mines.

COPPER

Eustis Mining Co., Eustis, Co. Sherbrooke.
The Nichols Chemical Co., Ltd., Capelton, Co. Sherbrooke.
J. McCaw, Sherbrooke.
G. E. Smith, do.
A. O. Norton, 280, Congress street, Boston, Mass.

LEAD

The British Canadian Lead Co, Ltd., Lake Temiscamingue, Co. Pontiac.

GOLD

The Gilbert River Gold Fields Co., Ltd., St-François, Co. Beauce.
The Dominion Mining Co. (C. A. Parson), P.O. B. 313, Boston, Mass.
Louis Mathieu & Cie., East Angus, Co. Compton.

GRAPHITE

The Anglo-Canadian Graphite Syndicate, Ltd., Buckingham, Co. Ottawa.
The Walker Mining Co., Graphite City, Buckingham.
The Buckingham Co., Buckingham.
Calumet Graphite Co., Calumet.

MANGANESE

The Magdalen Islands Co., 9½, St. Peter street, Quebec.

ASBESTOS

Bell Asbestos Co., Ltd., Thetford Mines, Co. Megantic.
King Bros. Co., Thetford Mines.
Johnston Asbestos Co., Thetford Mines.
The Beaver Asbestos Co., Thetford Mines.
American Asbestos Co., Ltd., Black Lake, Co. Megantic.
The Standard Asbestos Co., Ltd., Black Lake.
The Glasgow & Montreal Asbestos Co., Black Lake.
Manhattan Asbestos Co., Black Lake.
Union Asbestos Mine, Black Lake.
Syracuse Asbestos Co., Black Lake.
James Reed, Reedsdale, Co., Megantic.
The Broughton Asbestos Co., Ltd., East Broughton, Co., Beauce.
The Quebec Asbestos Co., East Broughton.
The Asbestos Mining & Manufacturing Co., Stenson, Co., Wolfe.
The Asbestos & Asbestic Co., Ltd., Danville, Co., Richmond.
R. H. Martin, New-York.
The Ottawa Asbestos Mining Co., 514, Sussex Str., Ottawa.

MICA

The Wallingford Mica & Mining Co., 41, Duke Str., Ottawa.
Blackburn Bros., 46, Sussex Str., Otttawa.
Wallingford Bros Ltd. 24 Central Chambers, Ottawa.
Fortin & Gravelle, Hull, Co., Ottawa.
General Electric Co., Isabella Str., Ottawa.
The Laurentide Mica Co., Ltd., Bridge and Queen Str., Ottawa.
Vavassour Mining Association (E.F.Nellis),22 Metcalfe Str.,Ottawa.
Comet Mica Works, 398, Wellington Str., Ottawa.
Lila Mining Co., (D. L. McLean), 5, Sparks Str., Ottawa.
The Allan Gold Reefs Co., Ltd., Victoria Chambers, Ottawa.
Webster & Co., 274, Stewart Str., Ottawa.
T. J. Watters, Metropolitan Building, Ottawa.
Brown Bros., Cantley, Co., Ottawa.
Lewis McLaurin, East Templeton, Co., Ottawa.
Richard Moore, Pickanock, Co., Ottawa.
Joshua Ellard, Pickanock.
The Glen Almond Mica & Mining Co., Buckingham, Co., Ottawa.
Kent Bros., Kingston, Ont.

PURCHASERS OF MICA

The Laurentides Mica Co., Ltd., Bridge and Queen Str., Ottawa.
Eugene Munsell & Co., 332 Wellington Str., Ottawa.
General Electric Co., Isabella Str., Ottawa.
Webster & Co., 274, Stewart Str., Ottawa.
F. D. Moore, 354, Wellington Str., Ottawa.

PHOSPHATE

J. F. Higginson, Buckingham, Co. Ottawa.

PETROLEUM

The Petroleum Oil Trust Co., Ltd., Gaspé Basin, Co. Gaspé.

COMBUSTIBLE NATURAL GAS

The Canadian Gas and Oil Co., St-Grégoire, Co. Nicolet.

FELDSPAR

W. A. Allan, Victoria Chambers, Ottawa.

SULPHATE OF BARYTA

The Canada Paint Co., 572, William Str., Montreal.

PEAT

The Imperial Light, Heat & Power Co., Ltd., Liverpool, London & Glasgow Building, Montreal.

SLATES

Rockland State Quarry, New Rockland, Co. Richmond.

FLAG-STONES

F. R. Bishop. Bishop's Crossing, Co. Wolfe.

CEMENT

Th. M. Morgan, Longue Pointe, Montreal.
International Portland Cement Co., Ltd., Hull, Co. Ottawa.

GRANITE

Stanstead Granite Quarries Co., Ltd., Beebe Plain, Co. Stanstead.
S. B. Norton, Beebe Plain.
James Brodie, Graniteville, Co. Stanstead.
The Whitton Granite Quarry Co. St-Victor de Tring.
M. Fitzgerald, Ste-Cécile, Co. Compton.
Jean Voyer & Fils, Rivière à Pierre, Co. Portneuf.
Joseph Perron, Rivière à Pierre.
M. P. Davis, 48, Central Chambers, Ottawa.
J. Brunet (Laurentian Granite Quarry), Côte des Neiges, Montreal
J. A. Nadeau, Iberville.

BRICKS.—(The principal companies).

Thos. W. Peel & Co., Montreal.
J. Brunet & Cie., Montreal.
Chs. Sheppard & Son, Montreal.
Joseph Bernier, Montreal.
Joseph Descarries, Montreal.
Laprairie Brick Co., Laprairie.

Narcisse Blais, Quebec.
Frs. Grenon, Quebec.
Paradis & Létourneau, Quebec.
Laliberté & Fils, St-Jean Deschaillons, Co. Lotbinière.
Victor Charland, St-Jean Deschaillons, Co. Lobinière.
D. G. Loomis & Son, Sherbrooke.
Eastern Townships Brick & Manufacturing Co., Sherbrooke.

LIME.—(The principal companies).

Dominion Lime Co., Sherbrooke.
Cyrille Gervais, Montreal.
Olivier Limoges, Montreal.
Montreal Lime Co., Montreal.

To this list must be added that of companies using certain products of the mines to be manufactured in this Province.

The Electric Reduction Co., Ltd, Buckingham (ferro-chrome and phosphorus).

The Chemical & Fertilizer Co., Buckingham.
Mica Boiler Covering Co., Ltd, 92, Ann Str. Montreal.
Electro Manganese Reduction Co., Shawenegan.
Standard Chemical Co., Coaticook, (acetate of lime).
The Standard Drain Pipe Co. Ltd, Saint-Jean d'Iberville.
C. E. Dubord, Beauport, (refractory clay).
Geo. Bélanger, Beauport, (refractory clay).
The Montreal Terra Cotta Co. Ltd, Maisonneuve.

MILTON L. HERSEY, M. Sc., GOVERNMENT ASSAY LABORATORY,

146, St. James street, Montreal, Que.

Telephone (long distance) Main 252.

FEES FOR ASSAYS AND ANALYSES

		4 samples or less at one time each.	More than 4 at one time. each.
Gold		$1.00	$0.90
Silver		1.00	0.90
Gold and Silver		1.00	0.90
Copper		1.00	0.90
Lead		1.25	1.15
Zinc		1.50	1.35
Nickel		2.00	1.80
Platinum		2.00	1.80
Arsenic		2.00	1.80
Manganese		2.00	1.80
Chromium		2.00	1.80
Antimony		2.00	1.80
Bismuth		2.00	1.80
Silica	smelting quality of iron ores	1.00	0.90
Iron (metallic)		1.00	0.90
Phosphorus		2.00	1.80
Titanium		1.50	1.35
Sulphur		1.50	1.35
Alumina		1.50	1.35
Ferric Oxide		1.00	0.90
Lime		1.50	1.35
Magnesia		1.50	1.35
Graphite		1.50	1.35
Moisture		0.25	0.25
Combined Water		0.50	0.50
Insoluble Matter		0.50	0.50

Indentification of Minerals.—The laboratory is prepared to issue a report on samples, giving description as far as may be determined by rough qualitative tests, with the probable metallic contents or commercial value of the sample. A nominal fee of .5 c. is charged for each sample.

Determination of radio-activity of a mineral	$1.00
Ascertaining the presence of radium	3.00

CHIBOGOMO MINING DISTRICT

In my report for 1904, on my return from my exploration to Chibogomo, I wrote as follows : " I cannot too earnestly call attention to this new district and to the important discoveries made there, I consider it as destined to play a great *rôle* in the industrial development of our Province." It now affords me much pleasure to state that my previsions have been realized.

After the exploration of 1904, a syndicate was formed by Mr. P. McKenzie under the name of *The Chibogomo Mining Company, Ltd*, to take advantage of these discoveries and he secured the services of Mr. John E. Hardman, a very distinguished mining engineer and expert.

Mr. Hardman visited that district in the spring of 1905 and published a report for the company as well as special articles in the August and September numbers of the *Canadian Mining Review*, in which he expresses a very favorable opinion of the asbestos and gold. As the latter is Mr. Hardman's speciality. I quote his opinion respecting the great vein of quartz 40 feet wide at Portage Island :

"The average of all these samples in free gold reached the sum of $2.50 per ton, including a number of samples (seven in number) which gave no trace of gold. Separating the samples which were taken from the big or forty feet vein, from those which came from other places, the average result in free gold is $3.14 per ton, an amount, I must say, which was very gratifying and very surprising to me, also. As showing, however, the extreme variation in the amount of free gold in the samples, I may say that the smallest amount of free gold which I obtained was forty cents to the ton of rock, whereas the largest was $11.48 to the ton. In this connection it is worthy of note that the samples from the central cut were of very much higher tenor than those from the East or West cuts. The richest sample obtained, namely ; that of $11.48 to the ton, was from the former as were also the next richest, namely : of $8.64 and $8 per ton, and I, therefore, am of the opinion that the distribution of the gold is not uniform throughout the big vein, but that, as in other places, there are enrichments of this vein in places, and the central cut certainly appears to be one of these places.

"The total approximate value of that quartz in gold was determined by assays of a large number of specimens as varying from $8.00 to $10.00 a ton.

"Judging from 36 pannings, free gold was represented by $3.00 a ton. The gold is not evenly distributed, but presents the usual variations of all known deposits. Nevertheless, the high average of $3.00 in free gold in a deposit of such large dimensions leads to the hope of satisfactory results when transportation conditions will allow of its being pratically worked."

In the same season of 1905, Mr. A. P. Low, now director of the Geological Survey of Ottawa, was instructed to study the geology of that district, through which he had already travelled several times on his explorations towards the North.

In February, 1905. Mr. Low published a remarkable report containing a vast amount of practical information which will be very useful to prospectors in that district. He makes a rational and practical classification of the rocks of that region and compares some of them to the rocks of the rich Cobalt district. The report is interesting from beginning to end. but I have made an extract of the most salient points which I reproduce textually for the information of the public, as follows :

GEOLOGICAL DESCRIPTION.

Owing to the general disturbed condition of the rocks and to the number of intrusions of igneous masses, both acidic and basic, in all parts of the country, the geology of the region included in this report is varied and complicated.

The region, as a rule, is nearly flat, so that no considerable sections of the rocks are found in cliffs, as in other places. Large areas are covered with swamps, from which only occasional small knolls of rock rise above the level of the water, rendering the intervening geology a matter of opinion rather than one of fact. The surface of the dry land is usually thickly covered with a dense growth of small trees, while a deep carpet of moss hides exposures of rock that would otherwise be easily seen.

The above conditions and drawbacks confine the following geological description largely to the rocks found along the waterways followed on the exploration, and the geological coloring of the map only covers narrow belts along these routes, without any attempt to depict its entire surface.

More than three-fourths of the surface of the region is occupied by igneous rocks, leaving only comparatively small areas to the sedimentary. Among the latter are classed the flat-lying limestones and cherty dolomites of Mistassini in the northeast corner of the map. These closely resemble the Upper Huronian limestones about Lake Superior, but, being without fossils, their age cannot be definitely stated. Masses of conglomerate and finer-grained arkose rocks associated with diabase are found about the northern, western and southern shores of Wakonichi lake, in the northwestern part of Chibogomo lake and on the upper part of the Chibogomo river. The boulders of the conglomerate vary in size up to a diameter of several feet and are composed largely of different granites along with fewer boulders of light-green diabase and rounded flattened masses of dark-green schists. The cementing material of these conglomerates is a dark-green basic rock, very often schistose, and either pure or mixed with fine-grained arkose material very similar to that forming the boulders of the conglomerate.

The arkose rocks associated with the conglomerates vary in texture from fine to medium-grained, and are composed largely of partly rounded material showing the action of water. They are formed mostly of feldspar with quartz and a varying amount of mica, hornblende and chlorite, and appear to have been deposited in water as re-arranged material from the debris of rocks in the immediate neighbourhood. This is further accentuated by the change in the composition of the arkose in different places : where it rests upon granite it is red in colour and wholly composed of fragments of that rock ; in other places, where it is supposed to rest upon a more ancient dark-green schist, it contains much less red feldspar and more quartz and green chloritic material.

The matrix of the conglomerate and—to a less extent—that of the coarser arkose is a green basic rock now largely or wholly changed to chlorite and sericite, and is usually schistose. The presence of these minerals in the matrix points to the igneous origin of the cementing material and to the probability that showers of ashes or an outburst of diabase covered the loose materials of the conglomerate and arkose in the shallow waters along the shores of an ancient sea. In places—especially along the southwest shores of Wakonichi lake

—individual boulders and isolated masses of conglomerate are found at different levels in the mass of the green basic rock, and appear to show that the latter was originally sheets of trap in which portions of the conglomerate had floated, perhaps rising in its fluid mass by the difference of specific gravity between the trap and the granite boulders.

These conglomerate and arkose beds are taken to be of the same age as that of similar rocks found in the region west of Timiskaming Lake. There, they rest unconformably upon, and contain boulders of, a series of contorted underlying schists supposed to be the equivalent of the ancient rocks called Kewatin, while the overlying conglomerates and arkose are taken to be Lower Huronian. In the region under consideration this contact of conglomerates with underlying contorted schist was not seen, the only contacts observed being between the conglomerate and the underlying granite, but, as already stated, the conglomerate usually contains boulders of a more ancient basic schist, and the arkose in places consists of fine material such as would result from the decay of such schists. Thus, there is little doubt that the old Kewatin schists do, in places, underlie the bedded series here in a manner similar to their occurence west of Timiskaming Lake.

Small areas of highly crystalline gneisses and schists, resembling the Laurentian, are seen in a few places in this region, notably along the eastern and southern shores of Chibogomo lake, along the Chibogomo river, at and above Asinitchibastat Lake and on the Obatogamau river.

The undoubted igneous rocks are represented by a number of different areas of both acidic and basic constituency. The basic rocks are most wide-spread and probably represent three or more outbursts separated from each other by long intervals of time. The greater part of these rocks are medium to fine-grained diabase rendered more or less schistose by pressure and often by decomposition to chlorite and allied schists. As before stated, it is exceedingly difficult to distinguish between areas of different age in such rocks without actual contacts of the older and newer series and, unfortunately, no such contacts were observed in the region. If areas of the old Kewatin schistose diabase do outcrop there, they were not recognized and are in consequence included with the diabase and diabase schists which inclose masses of the conglomerate and arkose. The diabase is only foliated in places, and considerable areas may be found where it lies almost flat or in rounded low domes.

Diabase and its alteration products and schists, together with its associated conglomerates and arkose, underlie more than half of the region embraced by this report. Starting from the contact with the overlying limestones of Mistassini in the northeast corner of the map, a wide band stretches away to the west and southwest embracing the greater part of both shores of Wakonichi lake and extending thence to the northeast part of Chibogomo, where it is cut off by newer gabbro and granite. The diabase again appears in the southwest part of that lake and continues southwest to Obatogamau lake where it widens and embraces the area extending from the granite in the eastern part of Obatogamau lake to that of Presqu'ile lake, some twenty miles to the southwest. The western extension of the Wakonichi area of these rocks extends from the west side of the granite area there across to the Chibogomo river and then westward, embracing the country about Rush and Five-mile lakes and so to the north side of Opemiska lake, where it is cut off by a mass of gabbro. Its southern boundary to that lake is determined by the irregular outlines of the masses of granite and gabbro which separate it from the southern area of Obatogamau lake. To the northward of the granite and gabbro of Opemiska lake diabase and diabase schists are found along the Chibogomo river to its junction with the Obatogamau river, a short distance below which it is replaced by granite on the south. In addition to these large areas of diabase, smaller areas are found filling intervals between the different masses of granite and gabbro in the central part of the map, while small bands of the green schists are often seen inclosed in the masses of both these rocks.

The diabase lies in wide horizontal masses whose upper surfaces have been worn by denudation and ice-action into low domes and hummocks, where it is seen in an undisturbed state, and where it has not been rendered schistose by pressure. This state of the diabase points to its eruption by vents leading from the interior to or near the then thin crust of the earth. If the diabase spread out in great sheets or *laccolites* between different beds of stratified rocks in a manner similar to the eruptions about Thunder bay, Lake Superior, all traces of these overlying beds have been removed by denudation; and if the outflow was on the surface, as is the case along the east coast of Hudson Bay, erosion has carried away all the upper part of the mass which would have shown an amygdaloidal structure due to the expansion of gases contained in the molten mass near the surface.

Owing to the absence of any evidence, the manner of eruption can only be said to belong to one of these two classes.

The vents connecting the interior with the sheets of diabase may, in part, be represented by the masses of serpentine found about the shores of McKenzie bay, Chibogomo lake, which have a probable extension from there both to the east-southeast and west-southwest in the rough country of the southern ridge, already noted as crossing the region in those directions. This serpentine is now in the form of long narrow bands associated with similar bands of diabase schist, conglomerate and arkose all due to the flattening and lengthening of masses of these rocks by pressure. The serpentine forms two, and perhaps three, such bands stretching for several miles along the shores of McKenzie bay. This rock is a decomposition product of a coarse diabase rich in olivine, and, following the ordinary law that in eruptions the more basic material flows out last, it probably represents the last outflow of the diabase eruption which filled the vent and cooled there. Evidence is lacking to prove conclusively that the serpentine belonged to the eruption of the Lower Huronian diabase and not to the previous eruption of Kewatin age.

The gabbro and anorthosite rocks of the region are probably different phases of one irruption. Their coarse crystalline texture points to slow cooling at a considerable depth below the surface, while their contact with the diabase schist shows that they penetrate the latter and are consequently newer in age. The largest mass of these rocks is irregular in shape and extends westward from Sorcerer mountain and the northeast part of Chibogomo lake across Doré lake to Simon lake on the Chibogomo river. The second large mass is about three miles wide and extends for several miles east-and-west along the north side of Opemiska and Mikwasach lakes.

The acidic irruptive rocks are represented by three different granites. The oldest of these—a red to pink, hornblende-mica-granite—is seen about the northeast part of Wakonichi lake beneath the Lower Huronian conglomerate, most of whose boulders are derived from this granite.

A second hornblende-mica-granite is found on the west side of this lake where it cuts the conglomerate and its associated diabase schist, and is, in consequence, of Post Lower Huronian age. This granite is lighter in colour than the preceding and its hornblende is often decomposed to sericite, causing the rock to become a protogene-granite. The Wakonichi area probably extends several miles westward and may be connected with the small exposure of granite seen on the Chibogomo river a few miles below Asinitchibastat lake. A large area of similar granite is found in the southern half of Chibogomo lake and extends westward thence across the southern half of Doré lake. It is again seen on the second lake-expansion of the Chibogomo river and then on the western shores of Simon lake and from there to the west side of Asinitchibastat lake. Granite of this type is next met with on the south side of Opemiska and Mikwasach lakes and again directly west along the lower stretches of the Obatogamau river. It is very probable that these several areas join to form one long irregular mass extending from Chibogomo lake to and beyond the junction of the Chibogomo and Obatogamau rivers. When in contact with the gabbro the granite is the cutting rock. Another small area of pink to red hornblende-mica-granite occurs along the Obatogamau river at Mukwacha lake, this being perhaps a southwestern extension from the area of Chibogomo lake.

The third and probably the newest granite of the region extends from south of the limit of the map and from beyond the height-of-land to Obatogamau lake where it is found as far as Lemoine narrows. Similar granite is met with on the south side of Eau Jaune lake and along the southern and western shores of Presqu'ile lake. It is essentially a biotite-granite, white to light-pink in colour, usually medium to coarse-grained in texture and rarely showing gneissic structure. It is very feldspatic, with dark biotite, and it usually carries little quartz.

The glacial phenomena noted are confined to the direction of the glacial striæ, of which two distinct sets were found, the older being from N. 50° E. and the newer from N. 30° E.

ECONOMIC MINERALS

As may be seen from the geological description, the Chibogomo region is underlain chiefly by igneous rocks, and the deposits of economic minerals appear to be largely confined to one class of these, that is, to the diabase and to its alteration products—green schists and serpentine—together with its associated conglomerates and arkose, all of probable Lower Huronian age.

The large masses of newer gabbro and granite are not, in themselves, well mineralized, but they both appear to have been important factors in the deposition and concentration of ores in the diabase and diabase-schists, which they cut. In this respect the gabbro appears to have been the more active and it is in the neighbourhood of contacts between it and the diabase that the greatest quantity of sulphides of iron and copper were noted. In all probability, therefore, any large deposits of these minerals will be found in proximity to such contacts and attention may be drawn to the contacts between these rocks in the region stretching westward from the northeastern part of Chiboogomo lake across to Asinitchibastat lake and also to the contacts of the diabase with the gabbro on the north side of Opemiska and Mikwasach lakes.

Asbestos has been found in all the areas of serpentine discovered to date and there is little doubt extensions of these areas will be found both to the east and the west of their known occurrences about McKenzie bay.

The association of conglomerate and arkose beds with diabase and similar volcanic rocks bears a close resemblance to the occurrence of these rocks in the area about Timiskaming lake, where the small rich veins of silver, nickel and cobalt have been found. Up to the present time, no such deposits have been located in the Chibogomo region, but characteristic small veins of specular iron ore occur in these rocks, as well as small quantities of copper. The silver and associated ores of Cobalt are perhaps unique, and are probably due to certain conditions of which we at present lack all knowledge. These unknown conditions may exist at places in the wide area of conglomerate rocks about Wakonichi lake, but this can only be determined by close prospecting for the small but rich veins. It is thought well to call attention to the presence of these rocks about the northeast bay of Wakonichi, and also along and extending westward from its southwest shores, as well as on the islands and part of the shores of McKenzie bay and Paint Mountain island of Chibogomo lake, where they extend westward across the northern part of Doré lake. A small area also occurs at the south end of the first lake expansion of the Chibogomo river, below Doré lake.

The large masses of diabase and diabase schists, away from their contact with the gabbro and granite, do not appear to carry large quantities of sulphides, nor have these ever been found sufficiently concentrated to make workable deposits; thus, it would appear that little attention need be paid to prospecting them.

Throughout the region small quartz stringers and gash veins are numerous in the dark-green rocks but, as a rule, they hold very small quantities of sulphides, and samples from several of the larger veins gave, when assayed, only faint traces of gold.

The above short notes are given to indicate to the prospector the most promising localities in the region in which to search for minerals.

Gold.—The only ledge of gold-bearing quartz known to the writer is situated on the southeast side of Paint Mountain island. The vein is seen near the summit of the hill at an elevation of 130 feet above the water of Chibogomo lake and a few hundred yards from the shore. It occurs in a dark-green diabase-schist which, along the shore of the lake, is cut by many irregular dikes or tongues of lighter-coloured, coarser-grained gabbro and it is probably due to this penetration of the schists by the gabbro that the vein is mineralized with copper and gold.

The quartz has a large outcrop at the discovery point and smaller ones a short distance to the east and west of it. Openings along the vein, extending for 400 feet to the west of the large outcrop show that it runs nearly east-and-west and that it is paralled to the foliation of the surrounding green schists.

A cut about six feet deep made across the vein where it was first seen gives a width of thirty-seven feet to the larger mass which is separated by twenty-five feet of schist on the south from a second mass eight feet wide. Both are nearly vertical or dip at a high angle to the south. At a second cut, 165 feet west of the first, the main mass has a width of forty-three feet, but the second vein was not uncovered. The third opening, 400 feet west of the first, is through a considerable thickness of glacial drift with about a foot of ancient yellow soil between it and the rotted rock below. This cut has been carried only a short distance into the rotted rock, part of which is broken quartz and part rotten schist; the imperfect showing appears to indicate that the quartz vein was breaking into several stringers separated from one another by partitions of schist. In all, the length of the vein has been proved for about 500 feet, and there is little doubt that it will be found to have a considerable extension eastward, unless cut off by a fault.

The position of the vein in and parallel with the foliation of the schist points to this quartz mass being a large lens rather than a true fissure vein ; but, even as such, with its great size, it must contain many hundred thousands of tons of quartz. A number of quartz boulders are scattered along the hillside and down to the edge of the lake to the southwest of the outcrops on the hill. One of these large boulders on the shore of the lake contains free gold, and led to the discovery of the ledge. Both Mr. Obalski and Mr. Hardman are of the opinion that this string of boulders has descended by gravity from an extension westward of the quartz ledge in rear, while the writer believes that the boulders have been moved to their present position by glacial ice from their original position near the large outcrop of quartz.

The vein is largely quartz with considerable quantities of iron and copper pyrites scattered through the mass, sometimes in fairly large bunches ; these, towards the surface, have been partly decomposed to oxides. The gold is found both free and in combination with the sulphides of iron and copper, so that for its total extraction the cyanide process will be required.

The vein is advantageously situated for easy mining, while the necessary power for mining, hoisting, milling and other work might cheaply be developed at the fall of the southern outlet of Chibogomo where a plant capable of developing several hundred horse power could be installed at little expense, once the necessary machinery was landed there.

As has been already stated, a number of quartz veins throughout the region were sampled and they failed to give gold on assay, so that the occurrence in the quartz of Paint Mountain is the only deposit of gold discovered at the present time in the region, but, as this mass of quartz is found in the green schists close to their contact with the gabbro, it may follow that other masses of quartz, similarly situated, will be discovered containing gold. The most promising localities for the discovery of such veins are along both sides of the mass of gabbro extending westward from Chibogomo lake almost to Asinitchibastat lake.

Copper.—No large or important deposits of copper ore have been found in the region up to the present time, but in a number of places good signs of ore are to be seen and these may indicate the presence of valuable quantities of copper in their vicinity. Copper pyrites are most abundant in association with iron pyrites on Paint Mountain, where they occur as small stringers, usually along the contacts between the green schist and the tongues of gabbro which penetrate the schists. Some exploratory work has been done on a few of these stringers, but all have proved too small and disconnected to pay for working. Copper pyrites are also found in small quantities disseminated through the green schist and, more sparingly, through the gabbro here.

The schists of the northwest shore of Doré lake contain small stringers of quartz which, near the contact with the gabbro hold small quantities of sulphides of iron and copper. Similar small quantities were also observed in the quartz stringers farther westward in the schists, near contacts. These wide-spread occurrences of small quantities of copper in the schists point to the possibility of larger deposits being found in favoured localities of the region to the westward of Doré lake.

Small, thin partings of copper pyrites, found in the arkose rock about the head of the northeast bay of Wakonichi lake and along its discharge into Mistassini lake, are recorded as indications of copper ore in that rock.

Lead and Zinc.—Masses of galena, associated with zinc blende, have been recently found in the Upper Huronian limestone at the narrows, a short distance from the Hudson's Bay Company's post on Mistassini lake. This occurrence was not visited by the writer and little information has been obtained as to the size and probable value of the deposit.

Iron.—No deposits of iron ore of size sufficient to render them of economic value have, up to the present, been discovered in the region under consideration.

The conglomerate and arkose rocks about the northeast bay of Wakonichi lake contain many small veins of quartz and beautifully crystallized specular iron ore, and in places the ore occurs without the quartz. Where the arkose has been rendered schistose, as on the northwest side of Paint Mountain, the specular iron ore is found as thin partings in the schist. The ores at all these localities are never sufficiently concentrated to allow of economical mining.

A number of large angular rocks of lean jaspilite, a mixture of bands of red jasper and magnetite-hematite ores, were seen mixed with the granite and other boulders which line the eastern shore of Wakonichi lake. These angular blocks have evidently not been transported far from their original site and they probably come from the rough country to the northeast between Wakonichi and Mistassini lakes where they in all likelihood form part of the Lower Huronian bedded series of rocks. This is the most promising indication of the presence of valuable iron ores in the region, but the deposits must be richer in iron than are the loose blocks, before they will be of value as workable deposits of iron ore in the near future.

Asbestos.—Serpentine associated with conglomerate, arkose and green schist is found on both sides of McKenzie bay. These rocks have been subject to strong pressure perhaps due to the intrusion of the great gabbro mass to the west and south. No matter what the cause of the pressure may be, all these rocks have been forced into long narrow bands, and most of them display a schistose structure parallel to the length of the bands or from east-northeast to west-southwest.

Dark green impure serpentine is found along the north shore of McKenzie bay from near its western end to within a short distance of the mouth of Rapid river, which flows into the head of its northwestern cove. Bands of conglomerate, arkose and schist occupy the point dividing this from the next cove, and they are followed by a second band of serpentine which, with green schist, occupies the southeast side of the bay from the head of that cove to the narrows leading to the main lake. The western extension of the first or northern band crosses the head of the western end of McKenzie bay and occupies its southern shore for a mile or so to its head. Asbestos island, being in line between the outcrops on both shores, is also formed of serpentine belonging to this band. Owing to the thickly wooded country, with its surface deeply buried in moss, it is almost impossible to trace the bands beyond the shores of the bay and, up to the present, prospecting has been confined largely to the margin of the lake. Nothing is known of the western extension of this northern band except that it does not reach the shores of Doré lake.

As already stated, Juggler House is a sharp peak of schist about two miles beyond the western end of McKenzie bay. Cuming mountain lies about a mile to the north of it and a beautiful light-green serpentine, carrying excellent asbestos has been reported as occurring in its summit ; this serpentine probably forms a third band.

The eastern extension of the north band is lost in the low country on the north side of Rapid river, while the southern band is said to have been found crossing that stream some four or five miles to the northeast of McKenzie bay. To the west the southern band appears to end at the narrows. Areas of serpentine carrying asbestos are said to occur on the northern shores of Island bay, but they were not seen by the writer ; if they are there they must be small inclusions in the gabbro rocks which occupy that portion of the basin of Chibogomo lake.

The above description of the serpentine rocks shows that at least two bands are known, each having a breadth of upwards of a mile and each extending at least five miles in length, with the probability that they will be found to extend considerably farther.

These serpentines are of economic importance owing to the veins of asbestos contained in them. Asbestos was first discovered on Asbestos island and at that place alone have attempts been made to prove its quality and quantity ; in all other places, only the surface-weathered indications have been observed. Along the north side of the bay from Magnetic cone to near Rapid river the frequent outcrops of serpentine show in a number of places small reticulated veins of asbestos, none of which exceed half an inch across the vein. Along the south shore veins up to an inch in width were seen in a number of places. The eastern extension of this band to Rapid river is also said to contain good asbestos while that discovered on Cuming mountain is probably the best in the region.

Asbestos island is about a mile long and about half that distance across in its widest part. The serpentine on the southern side is dark brownish green, while on the northern side of the island it is much darker in colour, harder than the green variety and contains only small narrow veins of asbestos.

On the south side of Asbestos island six small openings have been made along the face of the hill into the serpentine rock ; not one of these is more than a few feet deep, nor do any extend below the surface-weathering of the rock, so that no clear idea can yet be had of the quality of the fresh asbestos of the interior. These pits extend along the face of the hill for a distance of upwards of five hundred yards from the west point of the island and, in all of them, veins of asbestos have been uncovered.

As at present situated, 205 miles from the end of the railway by the easiest route, the profitable mining of the Chibogomo asbestos is out of the question, but, with a railway built to the shores of the lake and with a reasonable amount of capital, there is little doubt that several of the areas of asbestos-bearing serpentine, if worked economically, would yield good profits even against the added railway haul to market.

The present cost of transport by canoes or by winter hauling from Lake St. John to Chibogomo may be taken at fifteen cents a pound. With a road cut directly through the bush, winter haulage would probably reduce this price by one-half, but even then it is doubtful if any active mining could be carried on at a profit in the best of the mineral deposits as yet found in the region. In the opinion of the writer all active work in the mines there must await the building of a railway to the shores of Chibogomo lake.

The above notes, which are a summary of Mr. Low's opinion, show all the importance that district can assume.

I would call the attention of prospectors to the possibility of finding platinum in that region. That metal frequently accompanies eruptive rocks of the serpentine class. In my exploration of 1904, I several times, while panning debris from Portage Island, found very fine colors of a native white metal possessing all the physical characteristics of platinum, but which I could not ascertain by chemical analysis.

One may also expect to find in all the serpentines of that period chromium which has already been indicated by chemical analysis.

Among the specimens submitted to me by Mr. McKenzie I noticed small stains of native copper in the chloritic schists accompanying the thick vein of auriferous quartz on Portage Island.

A specimen of magnetic pyrite or pyrothine from Portage Island, analyzed by Mr. A. Moscovici who accompanied the Chibogomo Mining Company's expedition as chemist, gives, 0.39% of nickel and distinct traces of cobalt. This variety was found only in very small quantities but it is interesting because it presents a certain analogy with the same ore from Sudbury.

A great many prospecting licenses have been taken out in this district and during last season a certain number of prospectors went over it.

In consequence of Mr. Hardman's report, the exploration syndicate who had sent him out acquired Portage Island and Asbestos Island from the Government and organized itself under the name of the *Chibogomo Gold and Asbestos Company Ltd.*, with Mr. P. McKenzie as manager.

During the winter of 1905-06 several small syndicates were organized and the Government granted a subsidy towards the making of a winter road to Lake Chibogomo which makes the transportation of provisions easier. Some prospectors have gone on the ground this winter and it is probable that the district will be well prospected during the coming season. The above named company proposes to develop the quartz vein and the asbestos indications.

NOTICE TO PROSPECTROS.

Mines belong to the Crown on all lots not patented previous to the 24th July, 1880, and the superficial owners have no right thereto unless they have been specially sold to them.

The Department grants *prospecting licenses* at the following rates :

On unsurveyed lands, $5.00 per square mile ;

On surveyed lands belonging entirely to the Crown, $5.00 per lot of 100 acres ;

On surveyed lands the surface whererof is sold, $2.00 per lot of 100 acres.

Such licenses convey the right to lease or purchase the mines that may be on the land. They are valid for three months and renewable at the Minister's discretion.

When a mine is discovered on land belonging to the Crown, a lease or mining license for it may be obtained on payment of a fee of $5.00 and of an annual rental of $1.00 per acre. The application must contain as accurate a description as possible and the mine must be staked out on the ground by posts. The Minister may require a survey to be made if necessary. An area not exceeding 200 acres can be granted to one person.

Such licenses are valid for a year ; they give the right to mine and are renewable, provided the fee and rent be paid previous to their expiry.

Mining lands may be sold at prices varying from $2.00 to $10.00 an acre according to the kind of mineral and proximity to a railway, in lots of 100 acres only. (See Mining Law.)

Applications are valid only when made to the Department of Mines at Quebec and are not taken into consideration, unless accompanied by the required sums.

Holders of prospecting licenses are requested to make a *bona fide* prospect of their territory and to report to the Department in order to obtain a renewal.

Every license for which a new fee is not paid on its expiry reverts to the public domain.

RARE EARTHS IN THE PROVINCE OF QUEBEC

By H. NAGANT, Chemical Engineer

The expression *rare earths* is used to designate a special group of metallic oxides difficult to reduce, somewhat resembling one another in their chemical and physical properties, and frequently associated together in a certain number of comparatively rare minerals such as : cerite, gadolinite, monazite, samarskite, thorite, fergusonite, zircon, etc. The majority of these oxides constitute powerful bases combined, in nature, with silicic, titanic, phosphoric, niobic and tantalic acids, to which is added fluorine. As an example of fluoride, fluocerite may be mentioned which contains about 80 per cent of cerium with a little yttrium. But, as a rule, minerals containing rare earths are most complex and, in addition to a whole series of rare earths properly so called, contain many other metallic oxides such as those of uranium, iron, manganese, lime, alumina, magnesia, as well as small quantities of lead, bismuth, tin, etc.

At present some twenty rare earths are known which may be classified in four principal groups :

1.—Glucinium.

2.—The cerium groups comprising the following metals : cerium, lanthanum, metals of the former didymium (praseodymium and neodymium) samarium, gadolinium, europium.

3.—The yttrium group : yttrium, erbium, terbium, ytterbium, scandium, holmium, thulium, dysprosium, philippium.

4.—The zirconium group : zirconium, thorium and germanium. Titanium, which forms part of this group, is omitted because it is no longer considered a rare element.

Several of these rare earths (thorium, cerium, zirconium, etc.), are used in lighting, either as filaments for electric light, or in making the incandescent mantles of the Auer and other similar lamps. The importance assumed in the past twenty years by the manufacture of those lamps with incandescent mantles has led to searches being made and to the mining in many countries of deposits of minerals containing rare earths.

With the progress in industrial chemistry now being made in connection with these interesting substances, new and remarkable properties are constantly being discovered and the applications of which they are susceptible are occupying more and more the attention of specialists. Finally, in these same rare earths are disseminated the famous radio-active metals, such as *radium*, polonium, radio-active thorium and uranium.

In the Province of Quebec the study and exploitation of rare earths are only at their inception. Those minerals which, a few years ago, were looked upon merely as the valueless refuse left from mines of mica (with which they are frequently met in pegmatite veins running through Laurentian gneiss), have at last attracted the attention of several owners of mica mines and it may happen, in the near future, that mica itself will be only of secondary importance as compared with minerals better appreciated and having a very high commercial value.

In his report for 1901 on "Mica in the Province of Quebec", Mr. J. Obalski had already given interesting indications regarding some minerals of rare earths found in various parts of the Province.

While briefly recalling the information on this subject contained in the report, I will add the results of fresh searches.

VILLENEUVE MINE—COUNTY OF LABELLE

In this mine, besides, the common beryl (now required for extracting the *glucinium* it contains) remarkable specimens have been found of cerite, pitchblende, monazite and uraninite (minerals of uranium and cerium).

MAISONNEUVE MINE—COUNTY OF BERTHIER

Beryl is found in it and especially samarskite which is a niobate and tantalate of uranium, of iron and of yttrium with a little tungstic acid. By analyzing the samarskite, I found a little *tin*. On examining it with the *scintilloscope* it gave some scintillations which indicate the presence of a radio-active metal, probably thorium.

In a neighboring specimen of samarskite, I recognized *fergusonite* which is a tantalo-niobate of yttrium and cerium, with zirconium, tin, iron and tungsten. This mineral is radio-active.

Tantalum, contained in samarskite and fergusonite, is a very hard metal, very refractory to fire and is now used in Germany in the manufacture of incandescent electric lamps, everlasting pens, etc.

In 1905, tantalum was worth $5,000.00 a pound, a price which necessarily restricted its use. Notwithstanding such an extraordinarily high price, its physical and chemical properties are so remarkable that the German firm of Siemens and Halske took out, in Germany and elsewhere, 200 patents of invention for various processes in connection with the preparation and use of this metal.

In the new electric lamps where the carbon filament is replaced by a tantalum wire, it appears that only one half the current required by ordinary lamps need be used to obtain the same intensity of light.

LAKE PIEDS DES MONTS MINE—CHARLEVOIX

It was in this mine, situate 17 miles north west of Malbaie, that the famous *cleveite* was found which, at the Liege Universal Exhibition attracted the attention of specialists to its very remarkable radioactive properties. Seen through the scintilloscope, the cleveite (which consists of oxydes of uranium and other rare metals) gives more numerous and stronger scintillations than the celebrated pitchblende of Bohemia from which Mr. and Mrs Curie extracted *radium.*

MINE IN TACHÉ TOWNSHIP, LAKE ST. JOHN

I have carefully examined some specimens of greenish or brownish black ore of vitreous aspect, from this new deposit which will be worked this year. The two varieties they contain are silicates of rare earths not yet mentioned in the Province : *gadolinite* and *orthite* (allanite).

Gadolinite.—Density 4.5—Hardness 6. 5 to 7 ; dust greyish green.

Gadolinite is a silicate of yttrium, lanthanum, iron and glucinium (10 per cent) ; it also contains all the metals of the yttric and erbic groups. It may be used for the purpose of extracting glucinium and yttrium.

Orthite (*allanite*).—Density, 3.20.—Hardness 5.5 to 6, dust greenish grey, Aspect vitreous and more or less resinous.—Color brownish black ; it swells in the flame of the blow-pipe yielding yellowish scoria. It is easily attacked by concentrated chlorhydric acid, forming a jelly (silica).

I noticed the presence of a small quantity of *tin* (about 2°/o) as well as scales of *native bismuth.*

It is a silicate of cerium and yttrium, with alumina, oxyde of iron lime and manganese.

These two minerals are not radio-active at least under the scintilloscope.

SOME TRADE PRICES.

With the ever extending discovery and utilization of rare earths for industrial purposes, the price of those minerals has greatly lowered in past years. Nevertheless, they still retain a high commercial value which deserves to be taken into consideration by all who take an interest in mining matters.

To convey an idea as to the relative value of some minerals of rare earths, I give prices taken from the catalogue of Messrs Eimer and Amend. of New-York, per pound of mineral.

Common beryl (silicate of aluminum and glucinium)........	$ 0 20
Allanite (silicate of cerium, yttrium, etc).................	0 10
Cerite (silicate of cerium, lanthanum and didymium)..........	0 50
Fergusonite, (niobate and tantalate of yttrium, cerium, zirconium, etc.)...	2 00

(In London, England. radico-active fergusonite fetches at least 50 cents an ounce.)	
Gadolinite (silicate of yttrium, lanthanum, glucina, etc.).....	2 50
Monazite sand (monazite is a phosphate of cerium, lanthanum, thorium, etc)................................	0 20
Pitchblende or uraninite (a mineral of uranium, cerium etc.)	5 00
(In London, radio-active cleveite—a variety of uraninite—is sold for $2.00 an ounce.)	
Samarskite (niobate and tantalate of uranium, iron and yttrium)......................................	1 00

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